

08/30/00
JC813 U.S. PTO

9-01-00

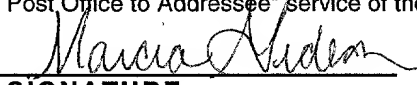
A

UTILITY PATENT APPLICATION TRANSMITTAL	Attorney Docket No. NAK-120	Total Pages
	First Named Inventor DALE BUERMANN	
	Title SIMULTANEOUS COMPENSATION OF SOURCE AND DETECTOR DRIFT IN OPTICAL SYSTEMS	

JC862 U.S. PTO
09/651421
08/30/00

APPLICATION ELEMENTS	ACCOMPANYING APPLICATION PARTS
1. <input checked="" type="checkbox"/> Fee Transmittal Form	8. <input checked="" type="checkbox"/> Assignment cover sheet and document(s)
2. <input checked="" type="checkbox"/> Specification Total Pages: [24]	9. <input checked="" type="checkbox"/> Power of Attorney by Assignee [] with CFR 3.73(b) statement
3. <input checked="" type="checkbox"/> Drawing(s) Total Sheets: [5]	10. <input type="checkbox"/> English Translation Document
4. <input checked="" type="checkbox"/> Oath or Declaration Total Pages: [1]	11. <input type="checkbox"/> IDS/PTO-1449 [] with copies of cited references
a. <input checked="" type="checkbox"/> Newly executed (original or copy)	12. <input type="checkbox"/> Preliminary Amendment
b. <input type="checkbox"/> Copy from a prior application 1.63(d) (complete Box 17 and note Box 5 below)	13. <input checked="" type="checkbox"/> Return Receipt Postcard (MPEP 503)
i. <input type="checkbox"/> Signed statement deleting inventors named in the prior application, see CFR 1.63(d)(2) and 1.33(b)	14. <input checked="" type="checkbox"/> Small Entity Statement [] Statement filed in prior application Status still proper and desired
5. <input type="checkbox"/> Incorporation by Reference (if 4b is checked) The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated therein by reference.	15. <input type="checkbox"/> Certified Copy of Priority Document(s) (if foreign priority is claimed)
6. <input type="checkbox"/> Microfiche Computer Program (Appendix)	16. <input type="checkbox"/> Other:
7. <input type="checkbox"/> Nucleotide/Amino Acid Sequence Submission (all the following are necessary)	
a. <input type="checkbox"/> Computer Readable Copy	
b. <input type="checkbox"/> Paper Copy (identical to computer copy)	
c. <input type="checkbox"/> Statement verifying identity of above copies	
17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information: [] continuation [] divisional [] CIP ...of prior application No.: []	

18. CORRESPONDENCE ADDRESS					
NAME	MAREK ALBOSZTA LUMEN INTELLECTUAL PROPERTY SERVICES				
ADDRESS	45 CABOT AVENUE, SUITE 110				
CITY	SANTA CLARA	STATE	CA	ZIP CODE	95051
COUNTRY	USA	TELEPHONE	(408) 260-7300	FAX	(408) 260-7301

Certificate of Mailing by "Express Mail"	
I hereby certify that I am mailing this correspondence on the date indicated below to the ASSISTANT COMMISSIONER FOR PATENTS, BOX PATENT APPLICATION, WASHINGTON, DC 20231 using the "Express Mail Post Office to Addressee" service of the United States Postal Service under 37 CFR 1.10.	
	DATE OF MAILING: EK994338721US
SIGNATURE	
MARCIA GIDEON	EXPRESS MAIL LABEL NO: 8/30/00
NAME OF PERSON SIGNING	

09/651421-0030000

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) and 1.27(d)) – SMALL BUSINESS CONCERN

Application No.: not yet assigned
 Filing Date: filed herewith
 Applicant(s): Dale Buermann
 Title: **Simultaneous Compensation of Source and Detector Drift in Optical Systems**

I hereby declare that I am the owner of, or an official empowered to act on behalf of, the entity identified below:

Name of Concern: **n&k Technology, Inc.**
 Address of Concern: **3150 De La Cruz Blvd., Suite 105
 Santa Clara, CA 95054**

I hereby declare that the concern identified above qualifies as a small business concern as defined in 37 CFR 1.9(d), for purposes of paying reduced fees to the United States Patent and Trademark Office under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention identified above and described in the application for Letters Patent filed herewith.

If the rights held by the concern identified above are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

Name:		<input type="checkbox"/> Individual
Address:		<input type="checkbox"/> Small Business Concern
		<input type="checkbox"/> Nonprofit Organization

Name:		<input type="checkbox"/> Individual
Address:		<input type="checkbox"/> Small Business Concern
		<input type="checkbox"/> Nonprofit Organization

I acknowledge the duty to file, in this application for patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

ASSIGNEE: n&k Technology, Inc.
 3150 De La Cruz Blvd., Suite 105
 Santa Clara, CA 95054

Official Authorized to Act on Behalf of Assignee:

Signature: *A. Rahim Ferozchi*
 Name: A. Rahim Ferozchi
 Title: President

8/29/00
 Date

Patent Application

5 of

Dale Buermann

for

10

**Simultaneous Compensation of Source and Detector Drift in
Optical Systems**

Field of the Invention

15 This invention relates to optical systems for performing
measurements, and in particular to an apparatus and method for
simultaneous compensation of drift occurring in a light source
and in a light detector.

20

Background and Prior Art

In many fields optical measurement methods are preferred over
other approaches because of their non-destructive nature and
high accuracy. For example, measurements of reflected or
25 transmitted light can be used to determine numerous physical
properties of objects. In fact, optical measurements can be
used to study the surface and the interior of objects or of the
layers of which the objects are made. The basic physical
parameters which can be derived from the study of reflected and
30 transmitted light include thickness, index of refraction,
extinction coefficient, surface roughness and energy bandgap of
the material making up the object or of a particular layer of
the object, e.g., the top layer. Other properties and
information about the object and/or its layers, such as

material composition, mechanical condition, doping level etc.
can be derived from these basic physical parameters.

5 The prior art teaches optical systems for performing optical
measurements using light reflected and/or transmitted by the
object being studied. Furthermore, methods for analyzing the
reflectance and transmittance data, e.g., spectrum,
polarization, intensity and other characteristics of the
reflected or transmitted light are also known. For example, in
10 U.S. Patent No. 4,905,170 Forouhi et al. describe an optical
method for determining physical parameters of thin films based
on reflectivity or transmittance data obtained over a range of
wavelengths.

15 Further improvements in optical measurement and analysis
techniques are frequently hampered by hardware problems.
Specifically, light sources delivering the light incident on
the samples are subject to intensity fluctuations. Also, light
detectors positioned to receive the reflected or transmitted
20 light are subject to fluctuations in detection sensitivity.
These fluctuations are typically non-uniform across any given
wavelength range and difficult to predict or unpredictable.
They are caused by external influences such as temperature,
pressure, humidity and operating conditions such as mechanical
25 vibration, current, wear, aging and others.

Over time, source and detector fluctuations add up to produce
source and detector drift. In general, the drift in the light
source is not related to the drift in the light detector.
30 Thus, in some cases the relative drift between source and
detector can be the sum of the drifts.

Fig. 1 shows a simplified prior art optical measurement system
10 having a light source 16 for illuminating a test sample 12

power supply (operating current) or varying the operating temperature (active heating and/or cooling). Meanwhile, detector drift is either assumed to be negligible and not taken into account or re-calibrated on an infrequent basis.

5

Advanced prior art optical measurement techniques, e.g., the Forouhi and Bloomer method, are very sensitive to drift. Hence, independent and uncorrelated drift in source and detector will prevent such techniques from yielding accurate values of physical parameters of test samples.

10

In addition, in some testing environments the optical measurement can not be interrupted to re-calibrate the source and/or the detector. This may be the case when the test sample is located in a controlled environment, e.g., a vacuum chamber, or when the measurement cycle is long and can not be halted. Under these conditions the optical measurement becomes progressively less accurate.

15

It would be an advance in the art to provide for simultaneous source and detector drift compensation without requiring that the measurement be stopped and without having to access the test sample.

20

25

Objects and Advantages

In view of the above, it is the object of the present invention to provide an apparatus and method for simultaneous source and detector drift compensation in optical systems. In fact, the object of the invention is to compensate for drifts occurring in the source and detector over time with minimal disruption to the optical system and without disturbing the test sample.

30

It is another object of the invention to provide an apparatus for source and detector drift compensation which can be used at

any time during a measurement cycle in an optical measurement system.

Yet another object of the invention is to provide a simple and
5 inexpensive apparatus for drift compensation which is easy to use.

Further objects and advantages of the invention will become apparent upon reviewing the below specification.

10

Summary of the Invention

The objects and advantages of the invention are attained by a method for simultaneously compensating a source drift of a light source and a detector drift of a light detector. A first
15 beam path is provided for a probe beam generated by the source and traveling from the light source to a test location. A second beam path is provided from the test location to the light detector. The beam paths are arranged to intersect or cross at a beam crossing.

20

A calibration sample is positioned at the test location and illuminated by the probe beam. In response, the calibration sample sends a known response beam along the second beam path to the light detector. The light source and the light detector
25 are calibrated using this known response beam from the calibration sample. For compensation, a reference sample is placed at the beam crossing. The reference sample is positioned such that in response to illumination by the probe beam it sends a reference beam along the second beam path to
30 the light detector. This reference beam is used to simultaneously compensate the source and detector drift. Conveniently, the calibration sample is a highly reflective sample of well-known reflectivity.

the light source, is then employed for compensating the source and detector drift using the reference beam. In fact, the first and second control units can be integrated in one control unit.

5

The light source can be any suitable light source spanning the desired wavelength range and can include incandescent bulbs, lasers and gas discharge tubes or any combination of such sources. For example, in measurements requiring reflectance or transmittance data in various portions of the spectrum, the source can be a broadband source made up of a laser and a discharge tube. Correspondingly, a broadband detector or a photospectrometer is chosen as the light detector.

15 Any known optical elements such as lenses, mirrors, gratings and other beam guiding elements can be used to guide probe and response beams between the source, test location and detector along their optical paths. When using broadband sources and detectors the use of reflective optics such as mirrors in the beam paths of probe and response beams is preferred to refractive optics. In one embodiment, the first beam path has a first mirror, such as a first toroidal mirror for guiding the probe beam. In fact, the first toroidal mirror collimates the probe beam to produce a collimated probe beam. A second toroidal mirror can be positioned to focus the collimated probe beam, e.g., into a fiber for delivery to the calibration sample or directly into the calibration sample. In another embodiment or in the same embodiment the response beam is collimated by a third toroidal mirror to produce a collimated response beam.

30 The collimated response beam is then focused by a fourth toroidal mirrors on the detector. It is preferable that the beam crossing be between collimated probe and collimated response beams. It is further preferred that a first optical path length from the first toroidal mirror to the second

toroidal mirror and a second path length from the first toroidal mirror to the fourth toroidal mirror be equal.

Brief Description of the Figures

- 5 Fig. 1 is a simplified prior art optical measurement arrangement exhibiting source and detector drift.
- Fig. 2 is a schematic view of an optical system according to the invention.
- 10 Fig. 3 is a schematic view of an embodiment of an optical system according to the invention using reflective optics.
- Fig. 4 is a schematic view illustrating a portion of the optical system of Fig. 3.
- 15 Fig. 5 is a schematic view of another embodiment of the optical system according to the invention using refractive optics.
- Fig. 6A illustrates a portion of another optical system according to the invention.
- 20 Fig. 6B illustrates a portion of still another optical system according to the invention.

DETAILED DESCRIPTION

Fig. 2 illustrates an optical system 50 for simultaneously compensating a source drift and a detector drift, which is used to measure physical properties of a test sample. As shown in Fig. 2, a calibration sample 52 is positioned at a test location and illuminated with a probe beam 54. Probe beam 54 is generated by a light source 56. Light source 56 can be a laser, a incandescent bulb, a gas discharge tube or any other light source capable of generating probe beam 54 of requisite characteristics. In many applications, probe beam 54 has to span a particular wavelength range $\Delta\lambda$. When wavelength range $\Delta\lambda$ is large, several light sources may be combined to form a broadband source.

accomplished by using any suitable beam guiding elements in beam paths 58, 66. In this embodiment a mirror 72 is used in second beam path 66 to re-direct reflected beam 62 such that it crosses probe beam 54 at beam crossing 70. Also, a focussing lens 74 is also positioned in second beam path 66 for focussing reflected beam 62 on detector 68. It will be clear to a person skilled in the art that optical elements used in beam paths 58, 66 to produce beam crossing 70 and properly guide probe and response beams 54, 62 will depend on the geometry of optical system 50.

When transmitted beam 64 is used as the response beam two planar mirrors 76, 78 guide transmitted beam 64 to cross probe beam 54 at beam crossing 70. Also, a focusing lens 86 is positioned between two planar mirrors 76, 78 for preventing the divergence of the transmitted beam 64. Again, a person skilled in the art will recognize that the optical elements to cross transmitted beam 64 with probe beam 54 at beam crossing 70 will depend on the geometry of optical system 50.

A removable reference sample 80 indicated in a dashed line is positioned at beam crossing 70. Preferably, a mechanical or an electro-mechanical unit (not shown) is used to place reference sample 80 at beam crossing 70 and remove it during measurement of a test sample. Reference sample 80 is a reflective sample over an entire wavelength range $\Delta\lambda$ of probe beam 54, and when in place at beam crossing 70 it reflects probe beam 54 to detector 68. The reflectivity R of the reference sample 80 is high enough to get a signal. For example, when probe beam 54 spans a wavelength range from 120 nm to 2000 nm reference sample 80 is a quartz sample exhibiting a nearly uniform 100% reflectivity over this wavelength range. Furthermore, the reflectivity of reference sample 80 can be closed to that of

remainder of optical system 50 for dynamic range purpose within a predetermined range.

Calibration sample 52 positioned at the test location is held
5 on a stage 82, of which only a portion is shown. Stage 82 enables calibration sample 52 to be moved or scanned as indicated by arrow A. In fact, stage 82 can be of the type permitting displacement of calibration sample 52 in any desired direction. In some embodiments calibration sample 52 is kept
10 in a controlled environment, e.g., in a vacuum chamber. In these cases stage 82 will exhibit the necessary adaptations, as is known in the art.

First control units 84 is connected to detector 68 for
15 controlling the detection sensitivity over wavelength range $\Delta\lambda$. Second control unit 88 is connected to light source 56 for controlling the light intensity over wavelength range $\Delta\lambda$. In particular, control units 84 and 88 have suitable amplification stages (not shown) to perform these adjustments.
20 Alternatively, control units 84 and 88 can be connected to control mechanisms of source 56 and detector 68 respectively. In yet another embodiment, additional tuning and/or adjustment devices can be used to control the intensity of light source 56 and sensitivity of detector 68. In fact, any approaches to
25 controlling source intensity and detection sensitivity known in the art can be employed. Alternatively, first and second control units 84 and 88 can be integrated in one control unit 90.

30 To calibrate the light source 56 and the detector 68, optical system 50 is first operated with the reference sample 80 removed from beam crossing 70. Calibration sample 52 is a reflective sample over wavelength range $\Delta\lambda$ and has a known reflectivity R, such as silicon wafer. For example, the

reflectivity R of silicon sample 52 is about 50% from 120 nm to 2000 nm (refer to a graph of reflectivity as a function of wavelength λ in Fig. 2).

5 In the present embodiment light source 56 delivers probe beam 54 covering wavelength range $\Delta\lambda$ and calibration sample 52 has a reflectivity R of approximately 100% across that wavelength range. In most cases, however, reflectivity R will vary as a function of wavelength λ ; $R=R(\lambda)$. The intensity I_s of probe
10 beam 54 is variable over wavelength range $\Delta\lambda$. In other words, I_s of probe beam 54 is also a function of wavelength λ ; $I_s=I_s(\lambda)$. Detector 68 is sensitive to light spanning wavelength range $\Delta\lambda$. However, the response of detector 68 is assumed to be linear since the response may differ with λ , but
15 current to number of photon is linear.

When probe beam 54 is turned on it propagates along first beam path 58 and is incident on calibration sample 52. In response, calibration sample 52 sends a known response beam in reflected
20 beams 62 along the second beam path 66 to the light detector 68. Since the reflectivity of calibration sample 52 is R, the following relationship exists between intensity I_s and detection signal I_d :

25
$$I_d=[R + \gamma(\lambda)]I_s,$$

where $\gamma(\lambda)$ is conditioned by system 50 and in particular the optical components in first and second beam paths 58 and 66. The entire spectrum of light of the known response beam is used
30 for calibrating the light source 56 and the detector 68.

Control unit 84 now performs a relative calibration of source 56 and detector 68 by adjusting the sensitivity of the detector 68. Adjusting the intensity of detector 68 is preferable

reference sample **80** sends a reference beam along the second beam path **66** to the light detector **68** in response to illumination by the probe beam **54**. This reference beam is used to simultaneously compensate the source and the detector drift of the optical system **50**. The compensation step can be repeated at any time by inserting the reference sample **80** at the beam crossing **70** after calibration of the light source **56** and detector **68** using calibration sample **52**. The compensation is based on a relation established between the known response of calibration sample **52** and reference beam of reference sample **80**. For example, the relation can be established based on the detector current intensities obtained while receiving the known response beam and the reference beam.

Now a simultaneous compensation of source **56** and detector **68** drifts is performed by control unit **88** to re-establish the relative calibration. Intensity I_s of source **56** can be adjusted to re-establish relative calibration. It should be noted that this re-calibration or re-establishment of relative calibration accounts simultaneously for both source and detector drifts, although no absolute calibration is achieved.

A preferred embodiment of an optical system **100** according to the invention is illustrated in Fig. 3. In this embodiment a light source **102** is an integrated source having a gas discharge tube **104** and a laser **106** for spanning a wide wavelength range $\Delta\lambda$.

A first beam path **108** for a probe beam **110** emitted from source **102** and coupled to an optical fiber **144** has a first toroidal mirror **112** and a second toroidal mirror **114**. First toroidal mirror **112** collimates probe beam **108** to produce a collimated probe beam **109**. Second toroidal mirror **114** focuses collimated probe beam **109** into an optical fiber **116**.

flexibility optical fibers. This flexibility permits the user to alter the arrangement of optical system 100 with minimal effort and in short time.

5 A further advantageous aspect optical system 100 is illustrated in the partial view of Fig. 4. Here the re-establishment of relative calibration between source 102 and detector 130 is being effectuated while reference sample 138 is in place at beam crossing 140. The optical path length between first
10 toroidal mirror 112 and second toroidal mirror 114 is equal to $L_1 + L_3$. The optical path length from first toroidal mirror 112 to second toroidal mirror 114 is equal to $L_1 + L_2$. It is preferable that $L_2 = L_3$ such that the optical path lengths from
15 first to second toroidal mirrors and from first to fourth toroidal mirrors are equal. In this manner any effects of system 100 on the propagation of probe beam 110 are factored out.

A further advantage optical system 100 resides in its usage of
20 toroidal mirrors. This is especially important when $\Delta\lambda$ is very large since chromatic effects are thus minimized.

Fig. 5 illustrates another embodiment of an optical system 200 according to the invention. System 200 uses refractive optics
25 in the form of lenses 202, 204 in a first optical beam path 206. Lens 202 collimates a probe beam 208 emerging from a light source 210 to produce a collimated probe beam 209. Lens 204 focuses collimated probe beam 209 into an optical fiber 212. Fiber 212 delivers probe beam 208 to a focusing lens 214,
30 which guides probe beam 208 to a calibration sample 216.

A response beam 218 in the form of reflected beam propagates from calibration sample 216 along a second optical beam path 220 and is in-coupled into an optical fiber 222. In fact,

CLAIMS

What is claimed is:

1 1. A method for simultaneously compensating a source drift of a
2 light source and a detector drift of a light detector, said
3 method comprising:

- 4 a) providing a first beam path for a probe beam traveling
5 from said light source to a test location;
6 b) providing a second beam path from said test location to
7 said light detector such that said second beam path
8 crosses said first beam path at a beam crossing;
9 c) positioning at said test location a calibration sample
10 for sending a known response beam along said second
11 beam path to said light detector in response to said
12 probe beam;
13 d) calibrating said light source and said light detector
14 using said known response beam;
15 e) placing a reference sample at said beam crossing for
16 sending a reference beam along said second beam path to
17 said light detector in response to said probe beam;
18 f) simultaneously compensating said source drift and said
19 detector drift using said reference beam.
20

1 2. The method of claim 1, wherein said step of
2 simultaneously compensating comprises establishing a
3 relation between said known response beam and said
4 reference beam.
5

1 3 The method of claim 1, further comprising placing a
2 test sample at said test location such that said test
3 sample sends a response beam along said second beam
4 path to said light detector in response to said probe
5 beam.
6

17 g) a reference sample for placing at said beam crossing for
 18 sending a reference beam along said second beam path to
 19 said light detector in response to said probe beam; and
 20 h) a second control unit for simultaneously compensating
 21 said source drift and said detector drift using said
 22 reference beam.

23

1 9. The system of claim 8, further comprising a test sample
 2 for positioning at said test location for sending a
 3 response beam along said second beam path to said light
 4 detector in response to said probe beam.

5

1 10. The system of claim 9, wherein said reference
 2 sample is selected such that the intensity of said
 3 reference beam is within a predetermined range of the
 4 intensity of said response beam.

5

1 11. The system of claim 8, wherein said calibration
 2 sample is a silicon sample.

3

1 12. The system of claim 8, wherein said light source is
 2 selected from the group of light sources consisting
 3 of incandescent bulbs, lasers, and gas discharge
 4 tubes.

5

1 13. The system of claim 8, wherein said light source is a
 2 broadband light source.

3

1 14. The system of claim 8, wherein said light detector is
 2 selected from the group of light detectors consisting
 3 of broadband light detectors and photospectrometers.

4

1 15. The system of claim 8, wherein said calibration
 2 sample is reflective calibration sample having a

toroidal mirror to said second toroidal mirror equals a second optical length from said first toroidal mirror to said fourth toroidal mirror passing through said beam crossing.

22. The system of claim 8, further comprising at least one lensing element positioned in said first beam path.

23. The system of claim 8, further comprising at least one lensing element positioned in said second beam path.

24. The system of claim 8, further comprising at least one optical fiber in said first beam path.

25. The system of claim 8, further comprising at least one optical fiber in said second beam path.



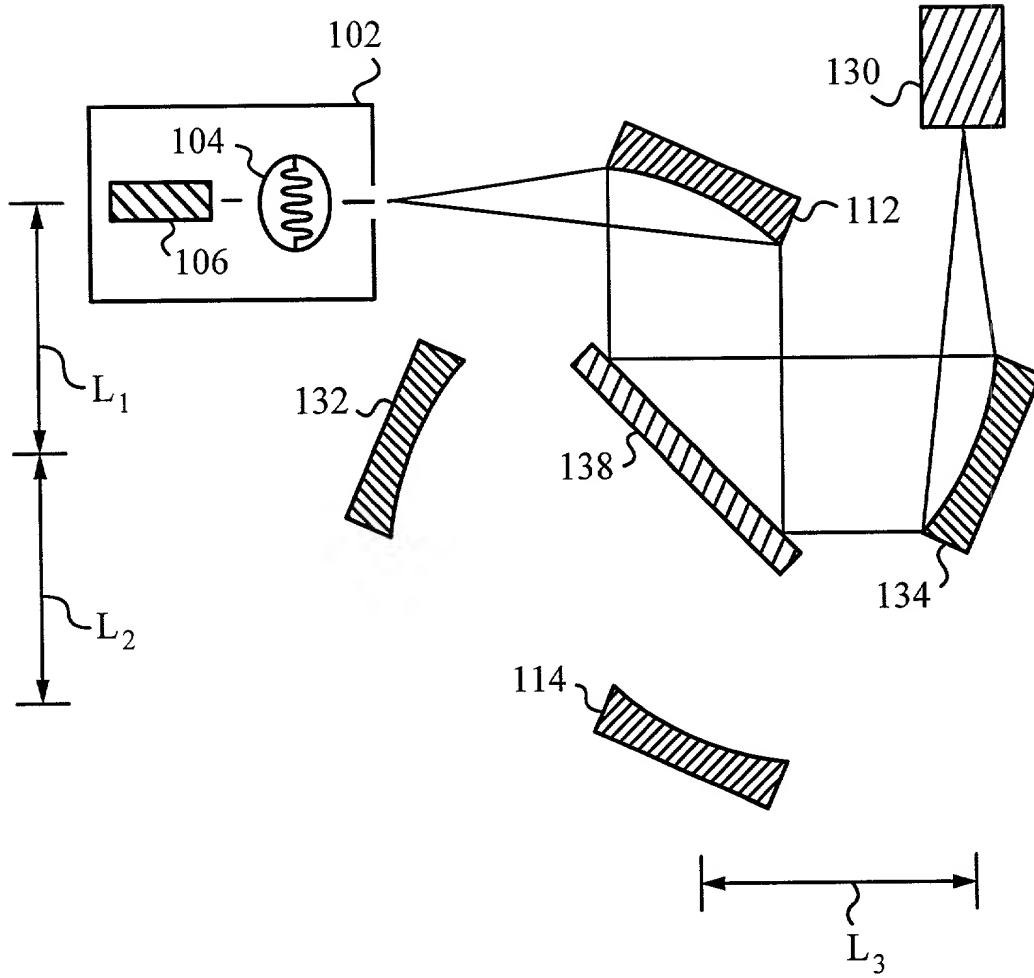


FIG. 4

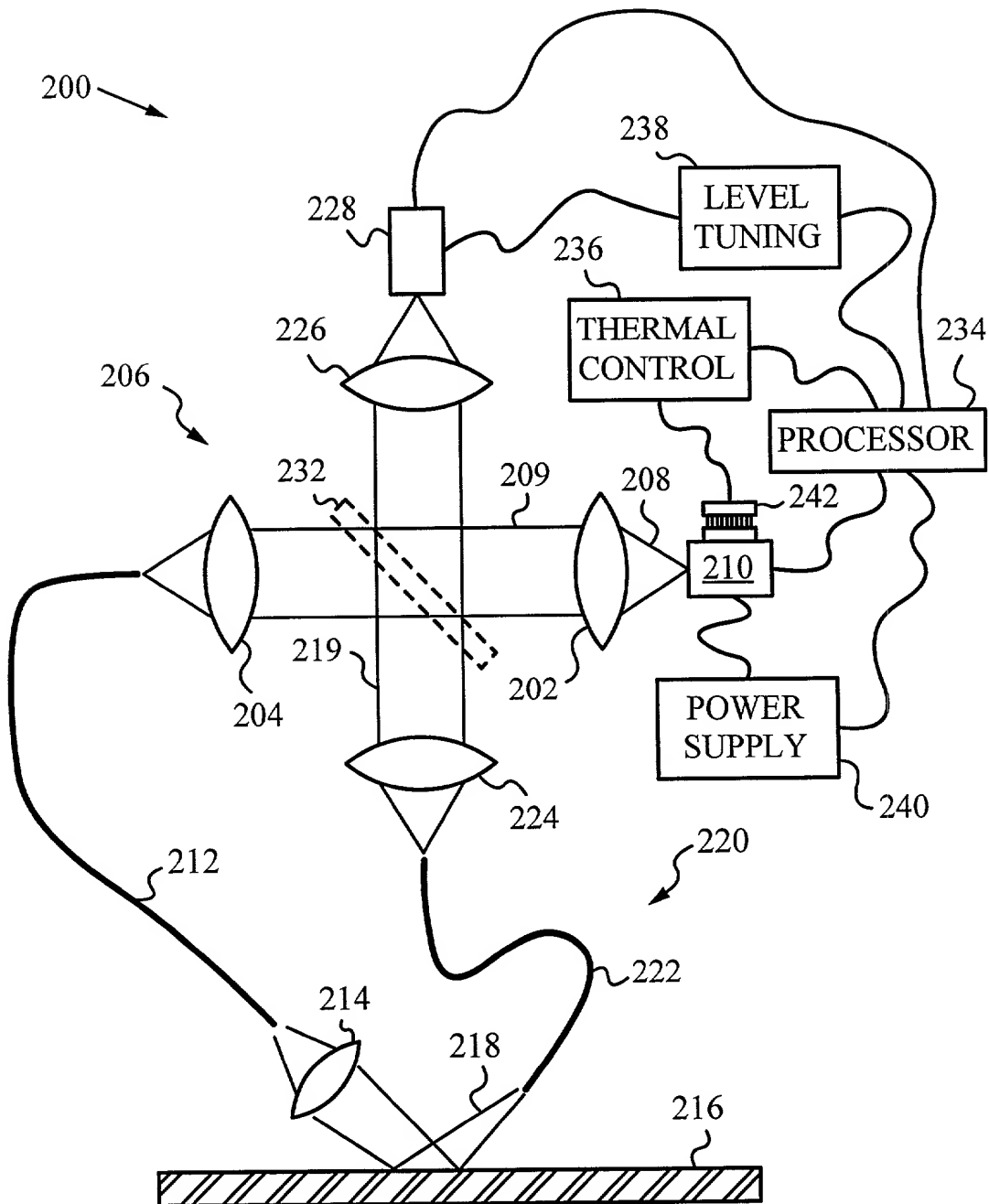


FIG. 5

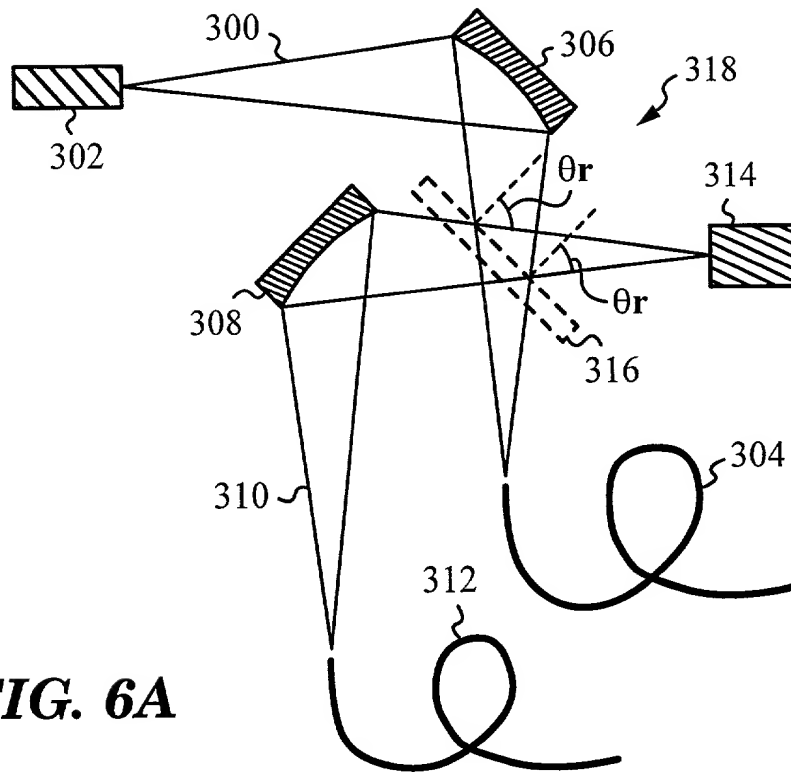


FIG. 6A

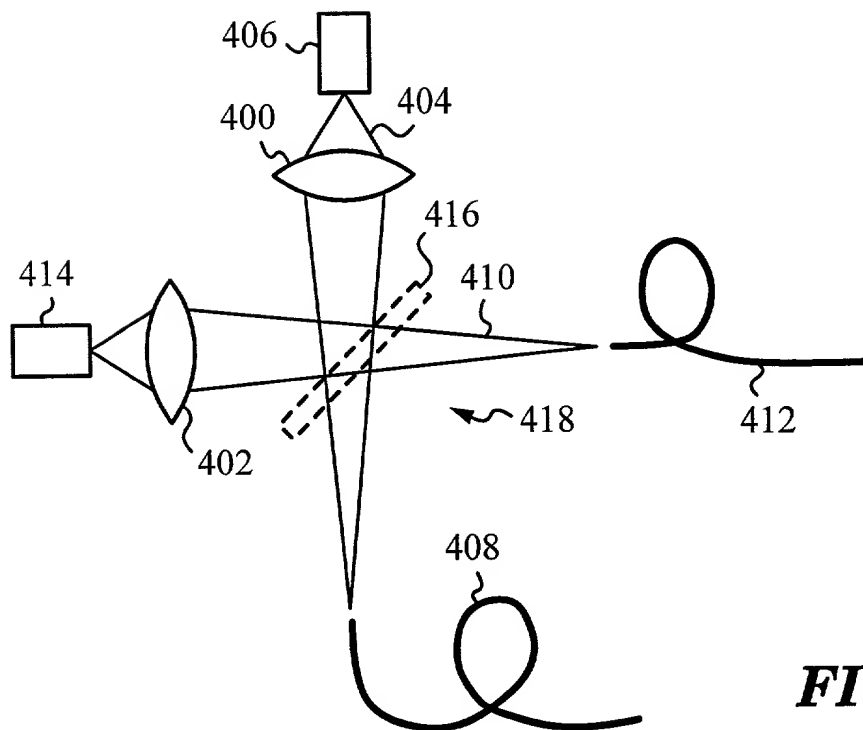


FIG. 6B

Declaration for Patent Application and Power of Attorney

As a below named inventor, I hereby declare that my residence, post office address, and citizenship are as stated below next to my name, and that I believe I am the original, first and sole inventor (if only one is listed) or an original, first and joint inventor (if plural names are listed) of the subject matter which is claimed and for which a patent is sought on the invention described in the attached specification entitled **Simultaneous Compensation of Source and Detector Drift in Optical Systems**.

First or Sole Inventor:	Full name:	DALE BUERMANN	Citizenship:	U S
	Residence:	1002 Mercedes Ave., Los Altos, CA 94022		
	Postal Address:	same as above		

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)

Country	Application Number	Date of Filing	Priority Claimed Under 35 U.S.C. §119
NONE			<input type="checkbox"/> Yes <input type="checkbox"/> No

I claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

PRIOR U. S. APPLICATION(S)

Application No.	Filing Date	Status			
NONE		<input type="checkbox"/> Provisional	<input type="checkbox"/> Patented	<input checked="" type="checkbox"/> Pending	<input type="checkbox"/> Regular

I hereby appoint Thomas J. McFarlane, Reg. No. 39,299, Marek Alboszta, Reg. No. 39,894, Joshua D. Isenberg, Reg. No. 41,088; Rena Kaminsky, Reg. No. 46,818 as my agents with full power of substitution to prosecute this application and transact all business in the United States Patent and Trademark Office connected therewith. Direct all correspondence to:

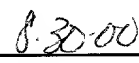
Marek Alboszta
 45 Cabot Ave., Suite 110
 Santa Clara, CA 95051
 Telephone: 408-260-7300
 Fax: 408-260-7301.

The attorney docket number for this case is: **NAK-120**.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Title 18, §1001 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

INVENTOR SIGNATURE(S)


 DALE BUERMANN


 Date

POWER OF ATTORNEY BY ASSIGNEE

The undersigned assignee of the entire interest in the attached application for Letters Patent for the invention entitled:

Simultaneous Compensation of Source and Detector Drift in Optical Systems

by virtue of Assignment recorded concurrently herewith hereby appoints Thomas J. McFarlane, Reg. No. 39,299, Marek Alboszta, Reg. No. 39,894, Joshua D. Isenberg Reg. No., 41,088, Rena Kaminsky, Reg. No. 46,818 as its attorneys to prosecute the attached application and to transact all business in the Patent and Trademark Office connected therewith, said appointment to be to the exclusion of the inventor(s) and their attorney(s) in accordance with the provisions of Rule 32 of the Patent Office Rules of Practice.

Please direct all communication relative to said application to the following correspondence address:

Marek Alboszta
Lumen
45 Cabot Ave., Suite 110
Santa Clara, CA 95051
Telephone: 408-260-7300
Facsimile: 408-260-7301

I am duly authorized to sign this instrument on behalf of assignee corporation. I hereby declare that, to the best of my knowledge and belief, title is in the assignee herein, and I affirm review of the Assignment document concurrently submitted and believe that the attached application has been assigned to assignee herein and that assignee therefore has the right to make this Power of Attorney and Exclusion of Inventor(s).

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

ASSIGNEE: n&k Technology, Inc.

3150 De La Cruz Blvd., Suite 105
Santa Clara, CA 95054

Official Authorized to Act on Behalf of Assignee:

Signature: _____

Name: _____

Title: _____

A. Rahim Forouhi

A. Rahim Forouhi

President

8/29/00

Date